

From the INTERNATIONAL BUREAU

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

Assistant Commissioner for Patents  
 United States Patent and Trademark  
 Office  
 Box PCT  
 Washington, D.C.20231  
 ETATS-UNIS D'AMERIQUE

Date of mailing (day/month/year)  
 21 July 2000 (21.07.00)

in its capacity as elected Office

International application No.  
 PCT/US99/22259

Applicant's or agent's file reference  
 17002-127-1PC

International filing date (day/month/year)  
 24 September 1999 (24.09.99)

Priority date (day/month/year)  
 25 September 1998 (25.09.98)

## Applicant

JOT, Jean-Marc et al

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

18 April 2000 (18.04.00)

in a notice effecting later election filed with the International Bureau on:

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2. The election  was was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
 34, chemin des Colombettes  
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Pascal Piriou

Telephone No.: (41-22) 338.83.38



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :  G11B		A2	(11) International Publication Number: <b>WO 00/19415</b>
			(43) International Publication Date: 6 April 2000 (06.04.00)
<p>(21) International Application Number: PCT/US99/22259</p> <p>(22) International Filing Date: 24 September 1999 (24.09.99)</p> <p>(30) Priority Data: 60/101,884 25 September 1998 (25.09.98) US</p> <p>(63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application US 60/101,884 (CON) Filed on 25 September 1998 (25.09.98)</p> <p>(71) Applicant (for all designated States except US): CREATIVE TECHNOLOGY LTD. [SG/SG]; 31 International Business Park, Creative Resource, Singapore 609921 (SG).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): JOT, Jean-Marc [FR/US]; 515 Townsend Drive, Aptos, CA 95003 (US). WARDLE, Scott [US/US]; 823 Riverside Avenue, Santa Cruz, CA 95060 (US).</p> <p>(74) Agents: YEE, George, B., F. et al.; Townsend and Townsend and Crew LLP, 8th floor, Two Embarcadero Center, San Francisco, CA 94111-3834 (US).</p>			
<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> Without international search report and to be republished upon receipt of that report.</p>			

(54) Title: METHOD AND APPARATUS FOR THREE-DIMENSIONAL AUDIO DISPLAY

## (57) Abstract

This invention addresses sound recording and mixing methods for 3-D audio rendering of multiple sound sources over headphones or loudspeaker playback systems. Economical techniques are provided, whereby directional panning and mixing of sounds are performed in a multi-channel encoding format which preserves interaural time difference information and does not contain head-related spectral information. Decoders are provided for converting the multi-channel encoded signal into signals for playback over headphones or various loudspeaker arrangements. These decoders ensure faithful reproduction of directional auditory information at the eardrums of the listener and can be adapted to the number and geometrical layout of the loudspeakers and the individual characteristics of the listener. A particular multi-channel encoding format is disclosed, which, in addition to the above advantages, is associated with a practical microphone technique for producing 3-D audio recordings compliant with the decoders described.

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DK	Denmark	LR	Sri Lanka	SG	Singapore		
EE	Estonia						



MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM,  
GA, GN, GW, ML, MR, NE, SN, TD, TG).

**(88) Date of publication of the international search report:**  
8 March 2001

**Published:**

— *With international search report.*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

Inten. Appl. No

PCT/US 99/22259

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04S5/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04S H04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 95 31881 A (CRYSTAL RIVER ENG INC) 23 November 1995 (1995-11-23) page 1, line 3-8 page 4, line 20 -page 7, line 3 page 8, line 21 -page 15, line 2 ---	1-49
A	US 5 682 461 A (LINK MARTIN ET AL) 28 October 1997 (1997-10-28) column 4, line 10 -column 8, line 48 column 10, line 6-49 ---	1-19
A	US 5 638 343 A (TICKNOR STEVEN R) 10 June 1997 (1997-06-10) column 1, line 8-12 column 2, line 44 -column 5, line 55 ---	20-49

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

### Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*&\* document member of the same patent family

Date of the actual completion of the international search

6 December 2000

Date of mailing of the international search report

14/12/2000

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

Authorized officer

Zanti, P

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

Intern. Inv. No.

PCT/US 99/22259

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
WO 9531881	A 23-11-1995	US 5659619 A			19-08-1997
		AU 703379 B			25-03-1999
		AU 2460395 A			05-12-1995
		AU 3675899 A			19-08-1999
		CA 2189126 A			23-11-1995
		EP 0760197 A			05-03-1997
		JP 11503882 T			30-03-1999
		US 6072877 A			06-06-2000
US 5682461	A 28-10-1997	DE 4209544 A			30-09-1993
		AT 193790 T			15-06-2000
		DE 59310056 D			13-07-2000
		WO 9319542 A			30-09-1993
		EP 0632944 A			11-01-1995
		ES 2146617 T			16-08-2000
US 5638343	A 10-06-1997	NONE			

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

YEE, George B.F. et al.  
TOWNSEND AND TOWNSEND AND CREW LLP  
Two Embarcadero Center, 8th Floor  
San Francisco, CA 94111-3834  
ETATS-UNIS D'AMERIQUE

**PCT**

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing (day/month/year)	07.06.2001
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Applicant's or agent's file reference 17002-127-1PC	<b>IMPORTANT NOTIFICATION</b>
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International application No. PCT/US99/22259	International filing date (day/month/year) 24/09/1999	Priority date (day/month/year) 25/09/1998
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Applicant CREATIVE TECHNOLOGY LTD. et al.
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1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

**4. REMINDER**

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The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Kiepe, C  Tel. +49 89 2399-2423
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**PATENT COOPERATION TREATY**  
**PCT**  
**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**  
**(PCT Article 36 and Rule 70)**

Applicant's or agent's file reference  17002-127-1PC	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No.  PCT/US99/22259	International filing date (day/month/year)  24/09/1999	Priority date (day/month/year)  25/09/1998
International Patent Classification (IPC) or national classification and IPC H04S5/00		
Applicant <b>CREATIVE TECHNOLOGY LTD. et al.</b>		
1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.		
2. This REPORT consists of a total of 7 sheets, including this cover sheet.		
<input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).		
These annexes consist of a total of sheets.		
3. This report contains indications relating to the following items:		
I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input checked="" type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application		

Date of submission of the demand  18/04/2000	Date of completion of this report  07.06.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Ernst, C  Telephone No. +49 89 2399 8958



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/US99/22259

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-19 as originally filed

**Claims, No.:**

1-49 as originally filed

**Drawings, sheets:**

1/13-13/13 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description,      pages:
- the claims,      Nos.:

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EXAMINATION REPORT**

International application No. PCT/US99/22259

the drawings,      sheets:

5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c));  
*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims 2-4,6-8,10-14,19,21-40,44-49
	No:	Claims 1,5,9,15-18,20,41-43
Inventive step (IS)	Yes:	Claims 32, 33, 37
	No:	Claims 2-4,6-8,10-14,19,21-31,34-36,38-40,44-49
Industrial applicability (IA)	Yes:	Claims 1-49
	No:	Claims

**2. Citations and explanations  
see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
see separate sheet

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US99/22259

**Section V**

Reference is made to the following documents:

D1: WO 95 31881 A (CRYSTAL RIVER ENG INC) 23 November 1995 (1995-11-23)

D2: US-A-5 638 343 (TICKNOR STEVEN R) 10 June 1997 (1997-06-10)

D3: US-A-5 682 461 (LINK MARTIN ET AL) 28 October 1997 (1997-10-28)

**1) Claims 1 to 8**

**Claim 1**

Claim 1 discloses a method for positioning of an audio signal. None of the documents disclose a method for positioning as such. However, since claim 1 contains only general features, the method known from the cited prior art according to figs. 1, 3 and 4 of the present application can be read onto claim 1.

Thus claim 1 does not satisfy the requirements of article 33(2) PCT.

From another point of view, it is obvious to select a set of spatial function for positioning a source (here an audio signal). In all equipment described as prior art in the present application (see fig. 1-4) sets of amplifier are used.

Since a real or virtual three dimensional sound is provided, it is obvious for the skilled person, that the interaural time delay difference (ITD) should be taken into account. Therefore the left signal should be delayed relative to the right one from this value. Thus claim 1 discloses an obvious way for the skilled person to position an audio signal.

From this point of view, claim 1 does not satisfy the requirements of article 33(3) PCT.

**Claims 2 to 8**

Claims 2 to 4 disclose different possibilities of use of spatial functions (spherical harmonic functions or discrete panning function).

Claim 5 is also known (see e.g. the prior art cited in the present application (fig. 1)). For three dimensional sounds, it is obvious to use four sets to define left, right, front and back signals (claim 6).

The features of claims 7 and 8 are standard features in the field.

Thus dependent claims 2 to 8 do not contain any features which, in combination with

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EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/US99/22259

the features of claim 1, meet the requirements of the PCT in respect of novelty and/or inventive step.

**2)Claims 9 to 14**

**Claim 9**

The statements related to claim 1 apply to claim 9.

Thus the subject matter of claim 9 is neither new nor involves an inventive step (art. 33(2) and 33(3) PCT).

**Claims 10 to 14**

Claims 10 to 13 are equivalent to claims 7, 2, 3, and 4. Storage means (claim 14) are also known from D2.

Thus dependent claims 10 to 14 do not contain any features which, in combination with the features of claim 9, meet the requirements of the PCT in respect of novelty and/or inventive step.

**3) Claims 15 to 19**

**Claim 15**

Claim 15 discloses a 3-dimensional audio recording system.

Claim 15 discloses only general features, so that D2 (see e.g. Abstract, col. 2, lines 10 - 13, lines 18 - 21) can be read onto claim 15.

Thus claim 1 does not satisfy the requirements of article 33(2) PCT.

**Claims 16 to 19**

The subject matter of claims 16 to 18 are also known from D2.

The feature that the decoder comprises filters defined and based on the spatial functions (claim 19) in a known feature in this field (see the cited prior art in the present application, and also D1).

Thus dependent claims 16 to 19 do not contain any features which, in combination with the features of claim 15, meet the requirements of the PCT in respect of novelty and/or inventive step.

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**4) Claims 20 to 40**

**Claim 20**

The statements related to claim 1 apply to claim 20.

Thus the subject matter of claim 20 is neither new nor involves an inventive step (art. 33(2) and 33(3) PCT).

**Claims 21 to 31, 34-36 and 38-40**

These dependent claims disclose features related to mathematics used to solve the equations using HRTFs signals.

Thus dependent claims 21 to 31, 34-36 and 38-40 do not contain any features which, in combination with the features of claim 20, meet the requirements of the PCT in respect of inventive step.

**Claim 32**

The structural features of claim 32 are neither disclosed nor suggested by the prior art.

Claims 33 and 37 disclose further steps of the method according to claim 32.

**5)Claims 41 to 49**

**Claim 41**

Claim 41 discloses a method for reproducing an audio scene.

Claim 41 only discloses general features, so that D2 (see e.g. Abstract, col. 2, lines 10 - 13, lines 18 - 21) can be read onto claim 41.

Thus claim 1 does not satisfy the requirements of article 33(2) PCT.

**Claims 42 to 49**

Claims 42 and 43 are also known from D2.

The use of synthesized audio signal is an obvious feature (claim 44).

The use of the spatial functions (spherical harmonics or discrete panning) is normal design procedure (claims 45 to 47).

The use of filters for decoding encoded signals (claim 48) is also a known feature (see also the statement regarding claim 19).

The step disclosed in claim 49 (the output is suitable for playback with speakers) is obvious (see also the problem cited in the present description).

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**Remark**

The examiner agrees with the statement cited on page 9, lines 2 to 12. However the features cited in this passage are not part of the claims.

It seems to be impossible to have a single general claim regrouping the modelling of HRTF and the method using reconstruction filters involving Binaural B Format according to claim 32 or figure 9, so that such two groups of claims will lead to a non-unity.

**Section VII**

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 to D3 is not mentioned in the description, nor are these documents identified therein.

The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).